

Systematic Review & Meta-analysis: automation tools to help your review

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<https://osf.io/8fsry/>

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Systematic Review & Meta-Analysis: Automation tools to help your review

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Centre for Research in Evidence-Based Practice

What is a Systematic Review?



- Systematic review sets is a structured process to identify all data relevant to a specific research question.
- May be followed by meta-analysis, a statistical process that provides a summary estimate of the outcomes from a group of studies

Replication Crisis?

Journal of Personality
Journal of Experimental Psychology
Psychological Science
Psychological Bulletin
Psychological Review

Why – what are the causes?

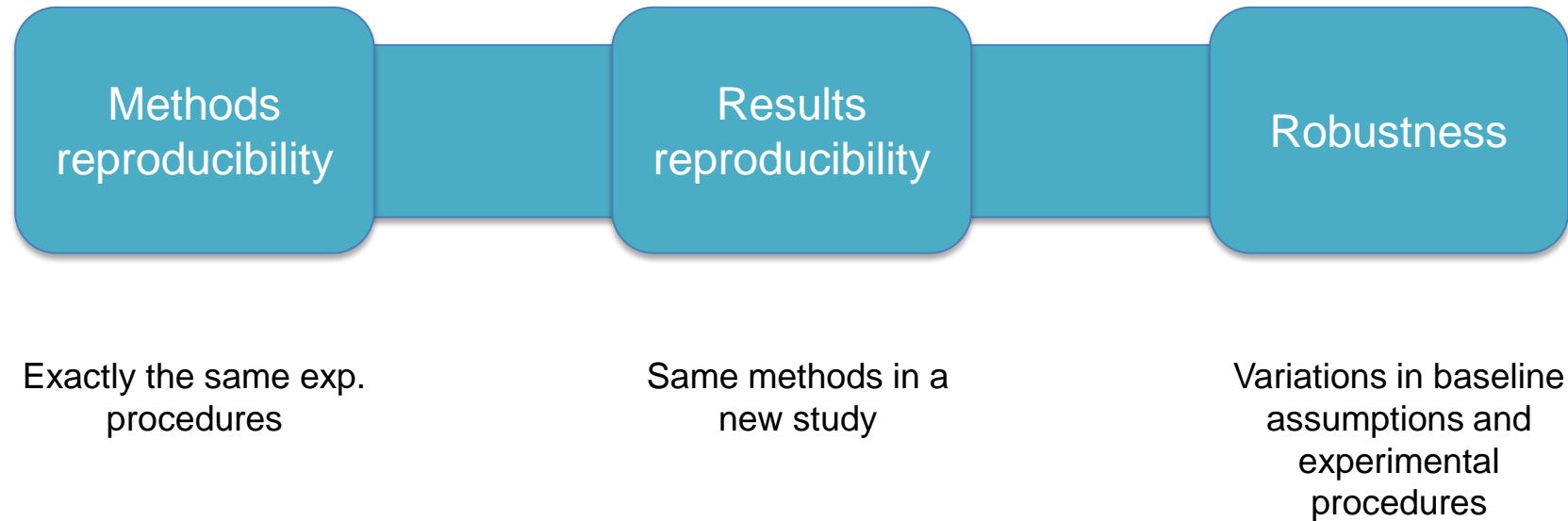
- Fraud ?
- False positive studies ?
- Perverse incentives & publication bias ?
- True psychological heterogeneity of observed effects ?

Average
psychosocial
powered
en 8-31%
t al., 2013)

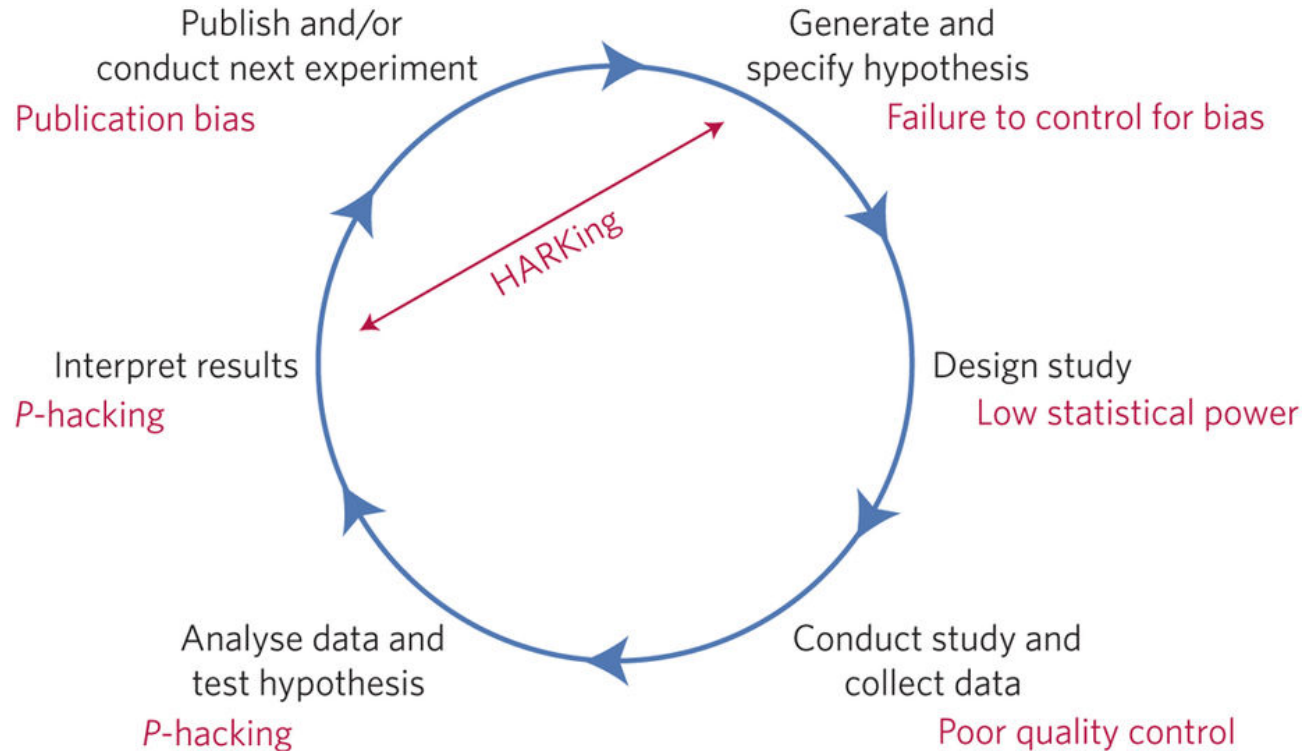
“Reproducibility in Science”, Begley & Ioannidis, Circulation Research. 2015;116:116-126

“Estimating the reproducibility of psychological science”, Open Science Collaboration, Science, 2015; 349(6251)

Reproducibility & Replication



Threats to reproducible science

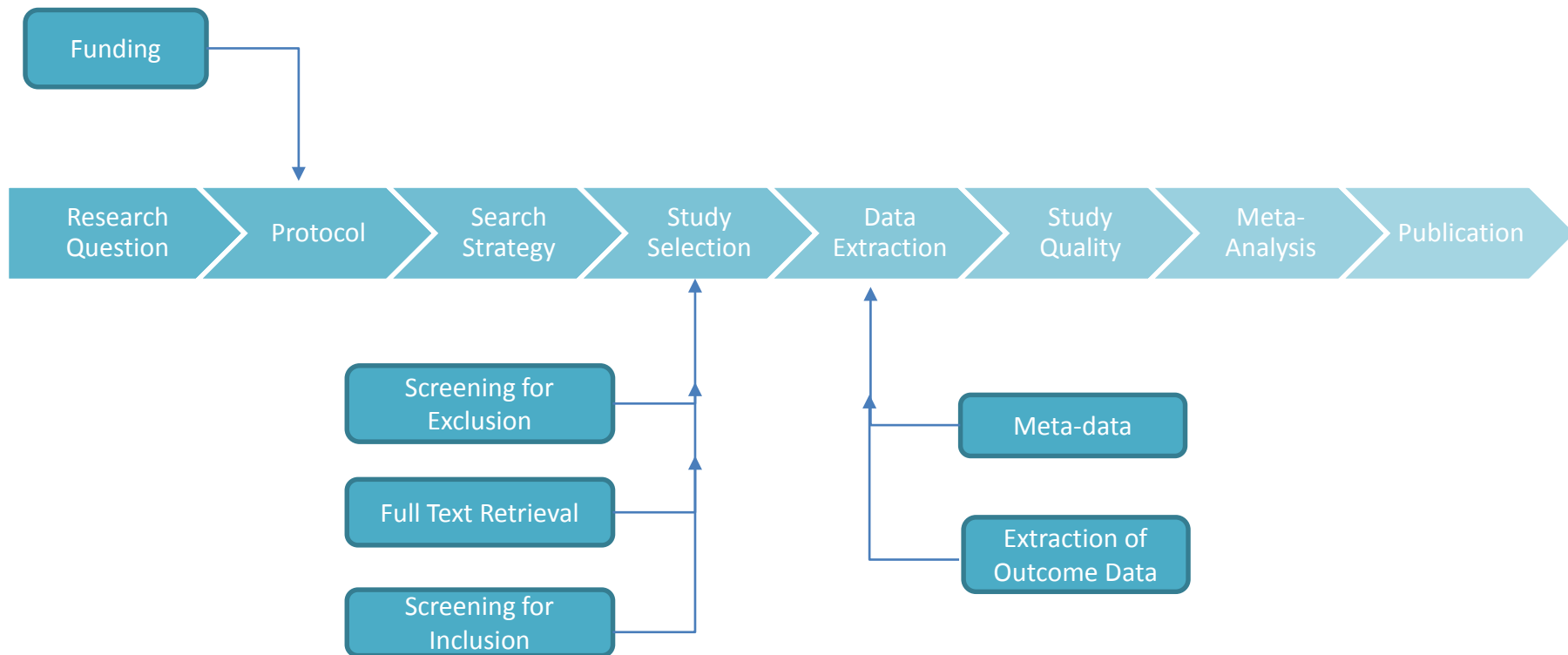


Why perform a systematic review?



- Provide an overview of available evidence
- Identify knowledge gaps
- Critical appraisal of study quality
- Identify factors influencing effects
- Inform experimental design of new studies
- Reduce waste in future research

Steps of A Systematic Review





Research Question



P – Population

- Characteristics of population

I – Intervention/Exposure

- Intervention

C – Comparison

- Alternative to intervention (e.g. placebo, standard care)

O – Outcome

- Relevant outcomes (How is it measured?)

T – Type of Scenario

- Therapy/Prevention, Diagnosis, Etiology, Prognosis



Protocol



- Research Question
- Searches & Search Strategy
- Define Inclusion & Exclusion Criteria
 - Population
 - Intervention
 - Control/Comparison
 - Type of Study
 - Primary Outcome
- Data Extraction Plan
- Quality Assessment
- Data Synthesis & Analysis Strategy
- Number of Reviewers at Each Stage



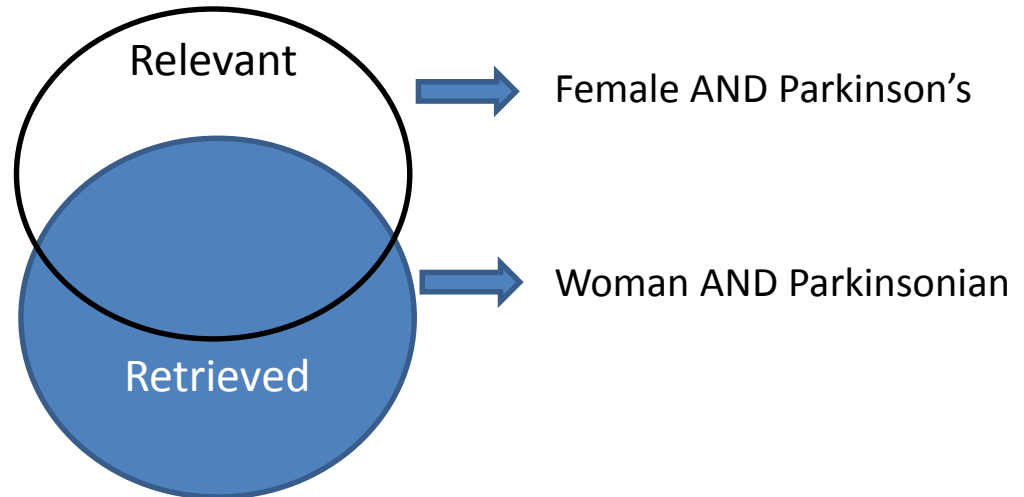
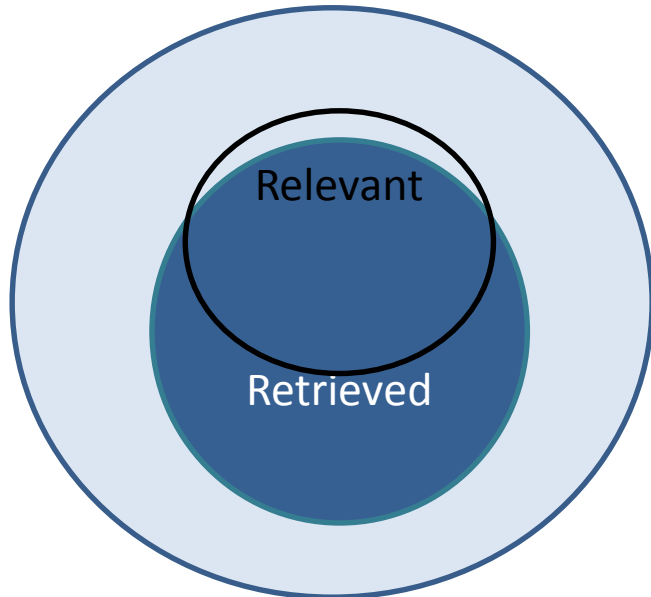
PROSPERO

International prospective register of systematic reviews



Comprehensive Search Strategy

- Ideally retrieve all relevant documents available
 - balance between sensitivity & precision

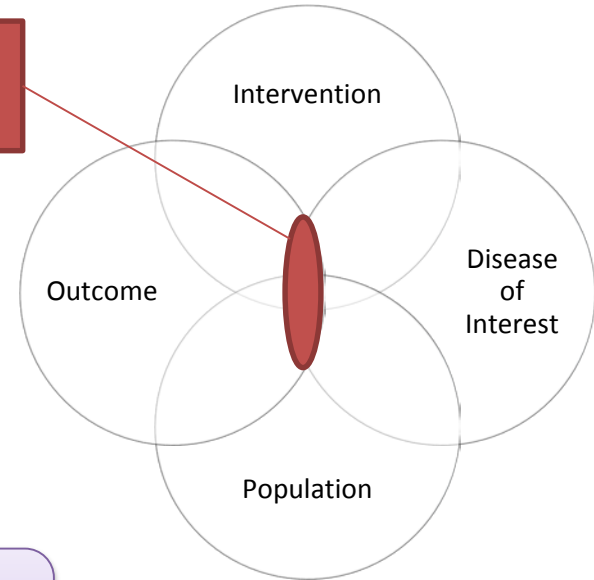


Comprehensive Search Strategy

Step A: Search Components

- Build your search
- Are there synonyms/standardised terms?

Relevant
Studies



Step B: Search Strategy

- Where will you search?

Ask your
librarian!

Why is searching properly important

Results of the search

*The search strategy found **8416** references in CENTRAL, MEDLINE, EMBASE and CBLD, whose titles and abstracts were screened, **8318** references were excluded and the remaining **98** articles were retrieved for detailed evaluation. On detailed examination, we excluded **68** articles.**



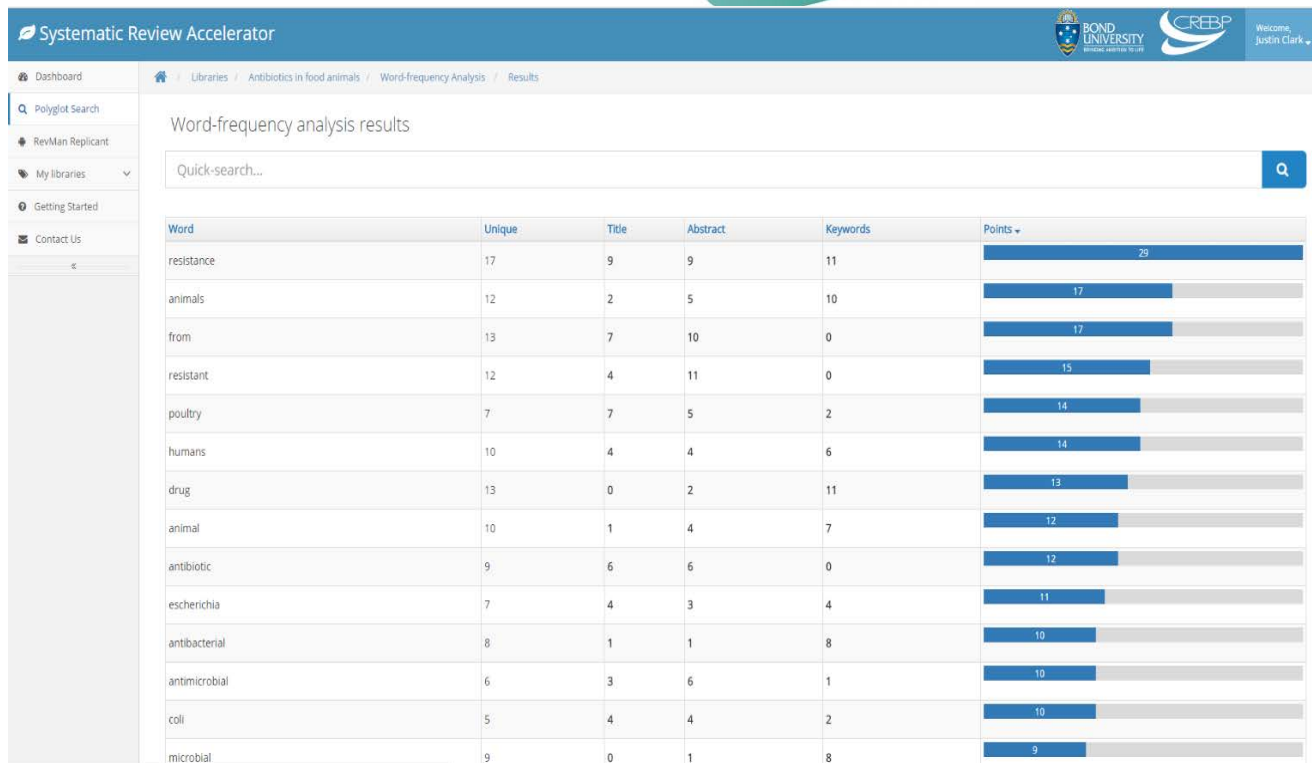
Trusted evidence.
Informed decisions.
Better health.



* Screened **8416** articles to find **30**.

Search building

Counts
frequency of
terms that
appear in the
title, abstract
and keywords of
relevant articles
to identify
search terms



Polyglot Search Translator DEMO



Translates a
PubMed or Ovid
Medline search
to an Embase,
CINAHL,
PsycINFO,
Scopus or Web
of Science
search

Systematic Review Accelerator

Dashboard / Polyglot Search

RevMan Replicator
My Libraries
Getting Started
Contact Us

Your query

("Drug Resistance, Microbial"[Mesh] OR "Drug resistance"[tiab] OR "Drug resistant"[tiab] OR "multidrug-resistant"[tiab] OR "multidrug resistant"[tiab] OR "Microbial resistant"[tiab] OR "Microbial resistance"[tiab] OR "Antibiotic resistance"[tiab] OR "Antibiotic resistant"[tiab] OR "Antibacterial resistance"[tiab] OR "Antibacterial resistant"[tiab] OR "Antimicrobial resistance"[tiab] OR "Antimicrobial resistant"[tiab])
AND
("Anti-Bacterial Agents"[Mesh] OR "Macrolides"[Mesh] OR "beta-Lactams"[Mesh] OR Antibacterial[tiab] OR Antibacterials[tiab] OR Antibiotics[tiab] OR Antibiotic[tiab] OR Macrolides[tiab] OR Macrolide[tiab] OR beta-Lactams[tiab] OR Antimicrobial[tiab] OR Antimicrobials[tiab] OR Penicillin[tiab] OR Methicillin[tiab] OR Ampicillin[tiab] OR Azithromycin[tiab] OR Cephalexin[tiab] OR Apramycin[tiab] OR Streptomycin[tiab])
AND
("Cattle"[Mesh] OR "Swine"[Mesh] OR "Poultry"[Mesh] OR "Farm animals"[tiab] OR "Food animals"[tiab] OR "Food systems" OR Cattle[tiab] OR Beef[tiab] OR Swine[tiab] OR Pig[tiab] OR Pigs[tiab] OR Poultry[tiab] OR Chickens[tiab])
AND
(Review[ti] OR "Systematic review"[tiab] OR "Meta-analysis"[tiab] OR Report[ti] OR Randomised[tiab] OR Randomized[tiab] OR Randomise[tiab] OR Randomize[tiab] OR Randomly[tiab] OR Controlled[tiab] OR "Control group"[tiab] OR Epidemiology[sh] OR "Morbidity"[Mesh] OR Comparison[tiab] OR Compared[tiab] OR Compare[tiab] OR Examined[tiab] OR Observations[tiab] OR Observed[tiab] OR Longitudinal[tiab] OR Experimental[tiab] OR Experiments[tiab] OR Investigate[tiab] OR (Before[tiab] AND After[tiab]))
AND

PubMed
Ovid Medline
Cochrane CENTRAL

((([mh "Drug Resistance, Microbial"] OR "Drug resistance":ti,ab OR "Drug resistant":ti,ab OR multidrug-resistant:ti,ab OR "multidrug resistant":ti,ab OR "Microbial resistant":ti,ab OR "Microbial resistance":ti,ab OR "Antibiotic resistance":ti,ab OR "Antibiotic resistant":ti,ab OR "Antibacterial resistance":ti,ab OR "Antibacterial resistant":ti,ab OR "Antimicrobial resistance":ti,ab OR "Antimicrobial resistant":ti,ab))
AND
((([mh "Anti-Bacterial Agents"] OR [mh Macrolides] OR [mh beta-Lactams] OR Antibacterial:ti,ab OR Antibacterials:ti,ab OR Antibiotics:ti,ab OR Antibiotic:ti,ab OR Macrolides:ti,ab OR Macrolide:ti,ab OR beta-Lactams:ti,ab OR Antimicrobial:ti,ab OR Antimicrobials:ti,ab OR Penicillin:ti,ab OR Methicillin:ti,ab OR Ampicillin:ti,ab OR Azithromycin:ti,ab OR Cephalexin:ti,ab OR Apramycin:ti,ab OR Streptomycin:ti,ab))
AND
((([mh Cattle] OR [mh Swine] OR [mh Poultry] OR "Farm animals":ti,ab OR "Food animals":ti,ab OR "Food systems" OR Cattle:ti,ab OR Beef:ti,ab OR Swine:ti,ab OR Pig:ti,ab OR Pigs:ti,ab OR Poultry:ti,ab OR Chickens:ti,ab))
AND
(Review:ti OR "Systematic review":ti,ab OR Meta-analysis:ti,ab OR Report:ti OR Randomised:ti,ab OR Randomized:ti,ab OR Randomise:ti,ab OR Randomize:ti,ab OR Randomly:ti,ab OR Controlled:ti,ab OR "Control group":ti,ab OR Epidemiology:sh OR "Morbidity":Mesh OR Comparison:ti,ab OR Compared:ti,ab OR Compare:ti,ab OR Examined:ti,ab OR Observations:ti,ab OR Observed:ti,ab OR Longitudinal:ti,ab OR Experimental:ti,ab OR Experiments:ti,ab OR Investigate:ti,ab OR (Before:ti,ab AND After:ti,ab)))
AND
((([mh Zoonoses] OR Zoonoses:ti,ab OR Zoonotic:ti,ab OR Transmitted:ti,ab OR Transmission:ti,ab OR Susceptibility:ti,ab OR Susceptible:ti,ab OR Selective:ti,ab OR Selection:ti,ab))

Embase

Translate a PubMed search into a Cochrane Library Search

- Behaviour therapy for children with anxiety
- <http://crebp-sra.com/#/polyglot>

Search refinement tool



 **searchrefiner**

Search

Enter query here.

Query Language [help?](#)

Ovid MEDLINE

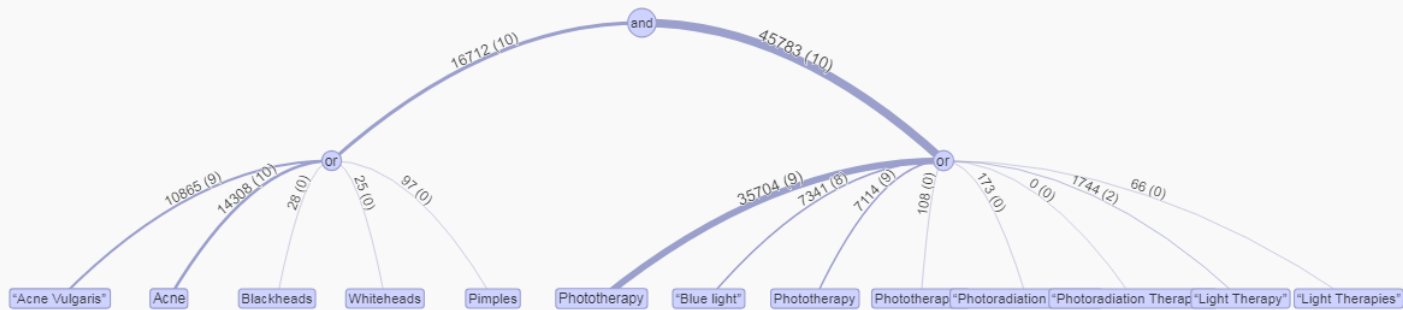
Submit

New search tool developed at
the CSIRO in collaboration
with CREBP

Harry Schells, Bevan Koopman
and Guido Zuccon

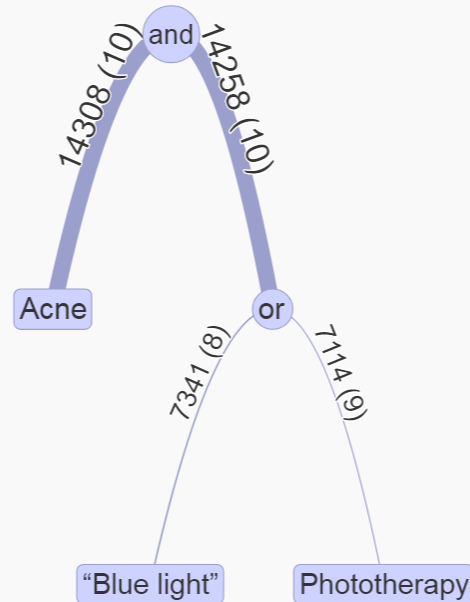
Refining the search

664 citations retrieved
10 citations relevant
10 citations relevant retrieved
[help?](#)



Search refined

137 citations retrieved
10 citations relevant
10 citations relevant retrieved
[help?](#)



Deduplication



- Systematic Review Accelerator (crebp-sra.com)
- Endnote

Rathbone *et al.* *Systematic Reviews* 2014, **4**:6
<http://www.systematicreviewsjournal.com/content/4/1/6>

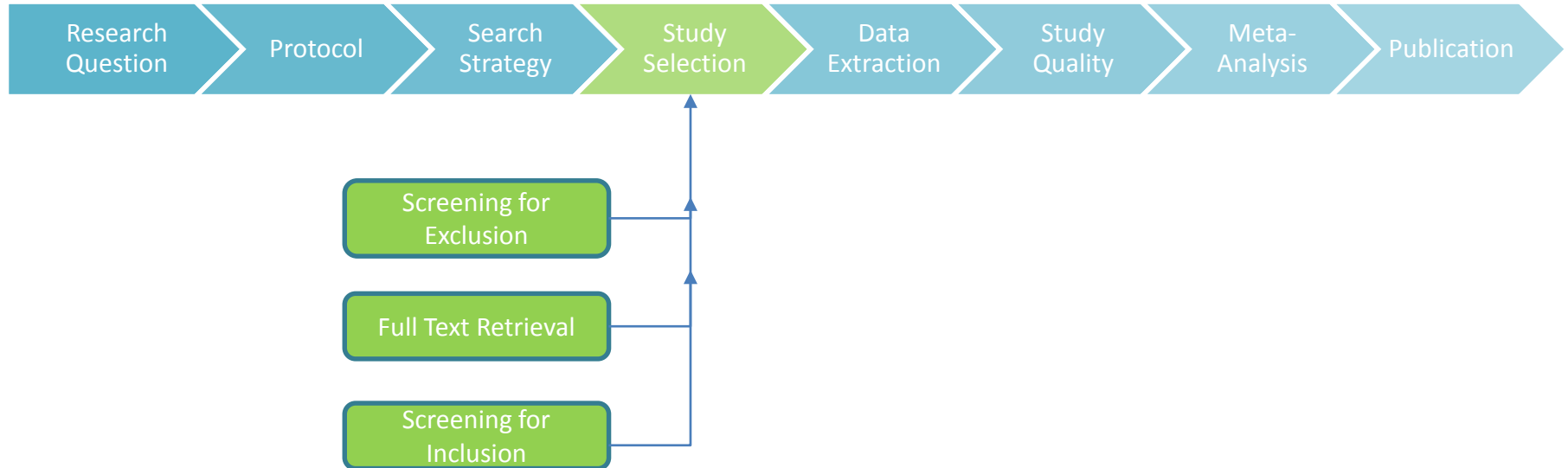


RESEARCH

Open Access

Better duplicate detection for systematic reviewers: evaluation of Systematic Review Assistant-Deduplication Module

John Rathbone*, Matt Carter, Tammy Hoffmann and Paul Glasziou



- *“The criteria used for including and excluding studies form the operational definition of the problem.” Abrami et al., 1988*
- Research question
- Study design
- Adequate data to extract meaningful information from
- Ambiguous methods/ methodological quality
- Often conducted in two stages: (e.g. title & abstract, then full text)
 1. Liberally applied to ensure relevant studies are included & no study is excluded without thorough evaluation
 2. More thorough application

Screening Tools



Tools to help speed up this process:

- SyRF (SyRF.org.uk)
- SRA Helper (CREBP-SRA.com)



 Systematic Review Accelerator

- Large systematic reviews (> 10,000 studies retrieved) - machine learning algorithms

Screening Tools DEMO



SYSTEMATIC
Review Facility

- App.syrf.org.uk
- <http://app.syrf.org.uk/projects/e45eb265-1a84-459d-9eb4-aa630d828659/detail>

Full text PDF retrieval



1. Endnote (find full text)
2. SRA Helper search
3. SRA PDF requestor (Bond only at the moment)

Ask your librarian!

- <https://www.dropbox.com/sh/w43a46fe6irtfdp/AAB3MmR4iIJFFlyDGtN2Rrd1a/EndNote%20Helper%20demonstration.wmv?dl=0>

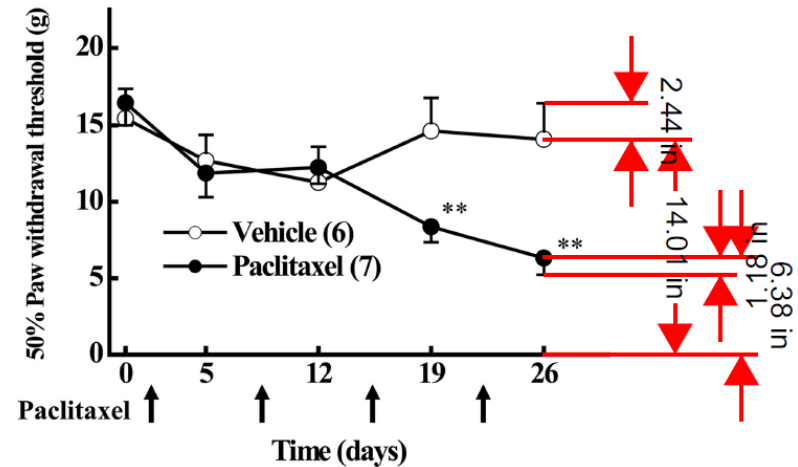


- Key study characteristics
 - Participants: Gender, Age, Level of Education
 - Length of follow up, number of times the outcome was assessed
 - How outcome was assessed? (e.g. Big 5, Myers-Briggs, Revised NEO)
- Meta-Analysis?
 - Effect size data
 - Correlation
 - Mean difference
 - Binary/dichotomous data

Data Extraction from Text, Tables & Graphs

- Tables & Text
- Graphs:
 - Universal Desktop ruler
 - [Webplotdigitizer](http://webplotdigitizer.com/)
- StatCheck (<http://statcheck.io>)
 - Looks for statistical reporting in articles in APA format → Excel spreadsheet of reported values and errors

A von Frey test



Where will you store your data?



- SyRF (SyRF.org.uk)
- RevMan
- MS Access

app.syrf.org.uk/projects/f6ea8176-d2eb-488d-804f-acfb0e1627bd/stage/db509738-a814-4f21-8754-8dd6b9d323ea/review/46428a37-2ca0-427a-a15f-2dbf36f50b7e/reconciliation=false

FreeCamp - Home CREBP-SRA Happy Git and GitHub SyRFshinyapp HSM Forms

SyRF Home Projects Ketamine in Animal Models of Depression: SR & MA Hello Alexandral Sign Out

Study Disease Model Induction **Treatment** Outcome Assessment Cohort Experiment

Drug A

Control procedure? ☐

Optional comments

Route of Administration *
Intraperitoneal injection

Optional comments

Time left between dosing and outcome measure*
24hrs

Optional comments

Frequency of dosing *
Once

Optional comments

Dose *
10

Optional comments

Dose units *
mg/kg

Optional comments

Age at treatment *
16 weeks

Optional comments

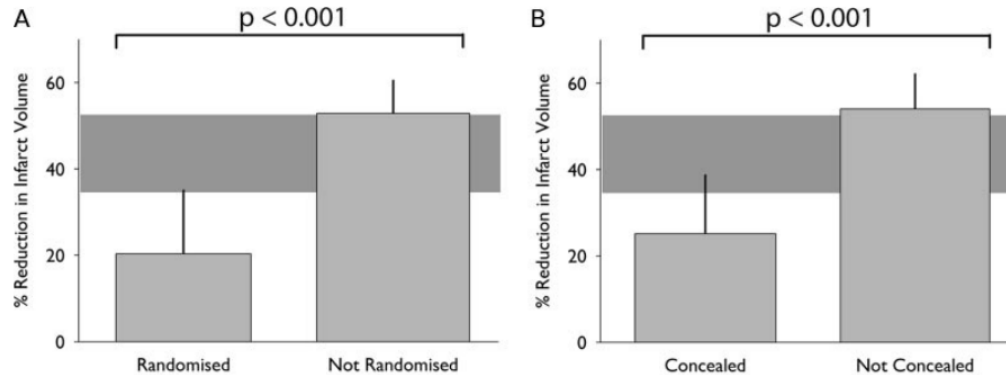
Form of ketamine used *
Ketamine

Optional comments



Why assess study quality?

- Low methodological quality can cause bias in the study results
 - Leads to an over- or under-estimation of true treatment effect



- The conclusions from your SR depend on the quality of the included studies!

- What factors are necessary to generalise the study results to other populations/patients/studies:
 - Participant characteristics (gender, age ..)
 - Intervention characteristics (timing, mode of delivery, intensity)
 - Modalities of outcome measure (how assessed, type, duration of follow-up..)

Internal Validity

Type of Bias	Description	Reduced By..
Selection Bias	Systematic difference in baseline characteristics of groups at baseline	Allocation Concealment Randomisation
Performance Bias	Systematic differences between groups in exposure to factors other than intervention of interest	Blinding Randomisation
Detection Bias	Systematic differences between groups in how outcomes are determined	Blinding Randomisation
Attrition Bias	Systematic differences between groups in the way drop-outs are handled	Reporting of Drop-outs

- [EQUATOR Network](#)
- Cochrane Risk of Bias (for controlled trials)
- Risk Of Bias In Non-Randomized Studies - of Interventions: ([Sterne et al., 2016](#))
- Transparent Reporting of Evaluations with Nonexperimental Designs: ([Des Jarlais et al., 2004](#); [CDC](#))
- Checklist for Reporting Results of Internet E-Surveys: ([Eysenbach et al., 2004](#))
- Self-Report Data: ([Stone & Shiffman, 2002](#))
- Qualitative Research: ([Elliott, Fischer & Rennie, 1999](#))
- Mixed Research: ([Leech & Onwuegbuzie, 2010](#))



Meta-Analysis

1. Check for homogeneity of included studies
2. Assemble relevant study data
3. Choose an effect size measure
4. Calculate the effect size for each study
5. Choose random or fixed effects model
6. Specify subgroups (if applicable)
7. Calculate the summary effect (per subgroup and overall)
8. Interpret results
9. Sensitivity analysis
10. Check for presence of publication bias

Prespecified

Meta-Analysis

- RevMan
 - RevMan Replicant
 - https://www.dropbox.com/s/my1kudy0ciw210j/Replicant%20tutorial_Aug18.mov?dl=0



- PRISMA
- MOOSE ([observational studies](#))
- JARS & MARS (APA)

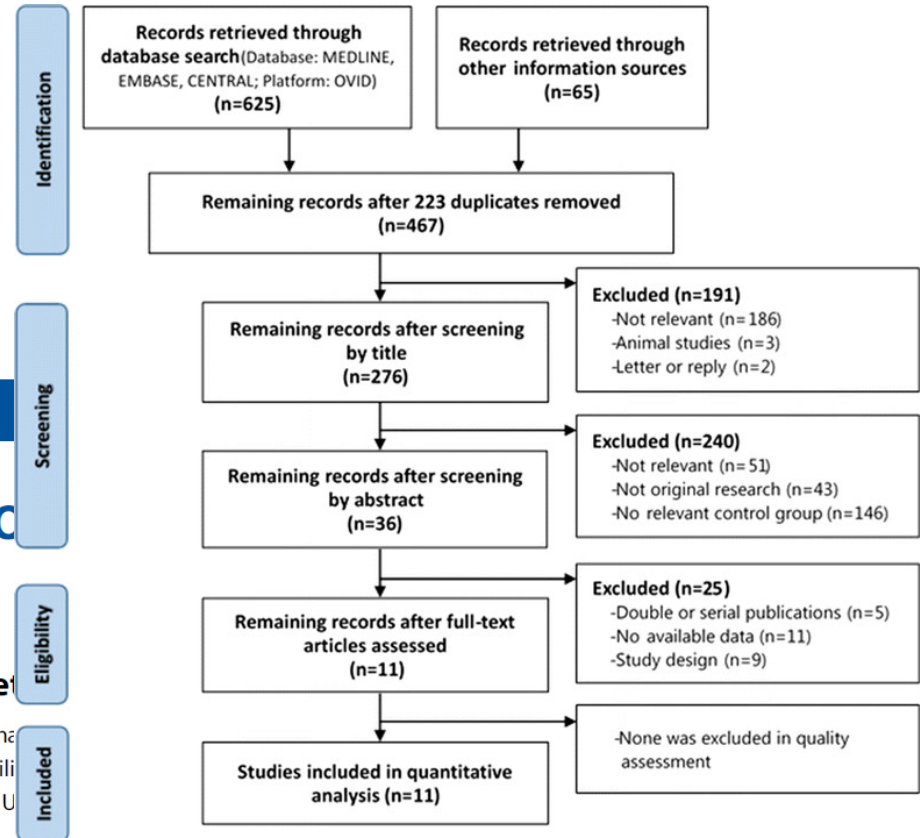
OPEN ACCESS Freely available online

Guidelines and Guidance

Preferred Reporting Items for Meta-Analyses: The PRISMA

David Moher^{1,2*}, Alessandro Liberati^{3,4}, Jennifer Tetzlaff⁵

¹ Ottawa Methods Centre, Ottawa Hospital Research Institute, Ottawa, Ontario, Canada, ² University of Ottawa, Ottawa, Ontario, Canada, ³ Università di Modena e Reggio Emilia, Modena, Italy, ⁴ Università di Bologna, Bologna, Italy, ⁵ Centre for Statistics in Medicine, University of Oxford, Oxford, UK



- **Study protocol**
 - Prospero
 - Publish
- **Literature search**
 - Librarian
 - Pubmed/Embase/PsychINFO
- **Deduplication**
 - SRA Deduplicator
- **Screening**
 - SyRF
 - Endnote Helper
- **Retrieve pdfs**
 - Endnote
- **Extraction**
 - SyRF
- **Quality Assessment**
 - Risk of Bias checklist
- **Meta-analysis per study protocol**
 - Borenstein *et al* 2009
 - STATA/R/SAS
 - RevMan
- **Drafting of manuscript**
 - PRISMA

Interested in using these free tools for your systematic review?

Contact:

- Alexandra Bannach-Brown – Research Fellow
(alexandra_bannachbrown@bond.edu.au)
- Justin Clark - Senior Research Information Specialist
(jclark@bond.edu.au)

